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Title of Abstract

Mean state, trends and variability of the Atlantic Subtropical Cells inferred from recent observations

Abstract (<200 words)

The Atlantic Subtropical Cells (STCs) are shallow wind-driven overturning circulations connecting the tropical upwelling areas with the subtropical subduction regions. In both hemispheres they are characterized by equatorward transport at thermocline level, upwelling at the equator and poleward Ekman transport in the surface layer. STCs are suggested to impact sea surface temperature variability in tropical upwelling regions on interannual to decadal time scales through the variability either in STC transport and/or hydrographic properties.
Here we present a 21st century mean state of the horizontal branches of the Atlantic STCs. Argo float data and repeated ship sections show that the equatorward part of the STCs can be observed between the 26.0 kg m-3 isopycnal and a seasonally varying upper boundary (30-70 m). Transport estimates within this layer reveal that the southern hemisphere contributes about 3 times more to the transport convergence between 10°N and 10°S than the northern hemisphere. In contrast, poleward transports in the surface layer driven by the Ekman divergence are rather symmetric. Overall, a residual transport of about 3 Sv remains. This missing transport could either be linked to diapycnal transport across the 26.0 kg m-3 isopycnal, as part of the Atlantic Meridional Overturning Circulation which partly upwells in the tropics, or to uncertainties of the transport estimates, particularly at the western boundary at 10°N.

From 2010 to 2017, both Ekman divergence and thermocline layer convergence between 10°N and 10°S suggest an increase in STC transport with a dominating contribution from the northern

hemisphere. The observations further show opposing thermocline layer transports at the western boundary and in the interior basin that are partly compensating each other. Implications of the increase in STC transport and variability of the STC hydrographic variability in the tropical Atlantic will be discussed.